Impression

Impression: It is the negative reproduction (or negative likeness) of the oral soft and hard tissue and their relationship. Impression can be made by placing fluid or semi-fluid material inside the patient's mouth and waiting until it sets, then removing it. From this (the impression) a positive reproduction, or cast is made.

Requirements of an impression material

1. It should be elastic after its placement in the patient's mouth so that it can be removed from the undercut areas that exist on the external tooth surfaces adjacent to the prepared tooth without distortion or fracture.
2. It should have adequate strength to resist breakage or tearing on removal from the patient's mouth (adequate tear strength).
3. It should have adequate dimensional stability over temperature and humidity ranges normally found in clinical or laboratory procedures for a period long enough to permit the production of a cast or die.
4. It should have adequate accuracy for the production of the fine details so that it is an exact negative reproduction of the prepared and unprepared teeth.
5. It should be easy to use with the minimum of equipment.
6. It should be free of toxic or irritating components.

Classification of impression materials

1. Non-elastic impression materials:
   a. Impression compound.
   b. Impression plaster.
   c. Zinc-oxide eugenol paste.

   These materials are not used routinely in crown and bridge work because when they set they become rigid, so upon removal from the undercut areas they will fracture or lead to trauma.

2. Elastic impression materials:
   a. Hydrocolloids (water-based systems):
      - Reversible hydrocolloids (agar impression material).
      - Irreversible hydrocolloids (alginate impression material).
   b. Elastomers:
Elastic Impression Material:

It is the type we use in our work because it is elastic so when we remove it from the undercut it will not fracture. If there is slight deformation upon removal, it will return to the original shape.

(a) Hydrocolloid:

(1) Irreversible (Alginate) (2) Reversible (Agar - agar).

1. Alginate is used to produce primary impression; it doesn't give us accurate details so we use it to produce the study cast only.

2. Agar -agar gives us accurate details but it needs specials tray and extra equipment so most of the dentists don't use this type of materials although it has accuracy.

(b) Elastomeric impression materials:

(1) Polysulfide polymer. (2) Silicon rubber base. (3) Polyether.

This type of impression set by chemical reaction. Usually is supplied in different consistencies (viscosity; which depends on the amount of fillers). These are heavy, medium and light, most of the time the heavy is used as tray material while the light body is used with special plastic syringe to be placed on the preparation. While the medium viscosity is mostly used in the prosthetic work like partial denture. * Whatever the consistency of the elastic rubber material it is supplied as two containers or tubes (the base and the catalyst).

1. Poly sulfide:-

The first type used in dentistry.

Base: a liquid polysulfide polymer mixed with inert. Fillers.

Catalyst: lead dioxide mixed with a small amount of sulfur and oil, act as oxidation initiators.

Disadvantages: -

1. Must be poured as soon as possible after taking the impression.

2. It has long setting time (about 10 min) so it's uncomfortable for the patient.

3. High temperature and humidity reduce its working time.
4. The material after polymerization is sticky so we should be careful in handling this material because it may stain the clothes.

2. Conventional Silicon impression Material:-

   (A) Condensation type:
   * Base: liquid silicon polymer with terminal hydroxyl group and filler particles.
   * Catalyst: A viscous liquid consists of ethyl-silicate with organic tin as activator (tin octet). Upon mixing, condensation reaction takes place with the elimination of *ethyl alcohol* as by-product this is responsible for the shrinkage of the material, which result in poor dimensional stability after setting.

Both polysulfide and conventional silicon after setting are dimensionally unstable because of the by-product. When we take impression by this material it must be poured 1 hr after we take it.

   (B) Addition type (vinyl polysiloxan silicon):
   * Base: silicon with terminal hydrogen group and inert fillers.
   * Catalyst: Silicon with terminal vinyl groups. Chloraplastinic acid as catalyst and other filler. Without elimination of by-product which result in a more dimensional stable material.

3. Polyether impression Material:

The material is two-paste system of medium consistency.

   * Base: Polyether polymer with terminal ethylene amine group with filler.
   * Catalyst: Alkyl aromatic sulfinate with filler particles.

This material absorbs moisture that might result in dimensional changes, it must be kept dry after taking the impression, and sometimes we can pour it after one day. It is stiff material and we should be very careful when removing it from the cast, because we might break the area of the prepared tooth.

General factors that affect most of elastic rubber impression material:-

1. The rubber impression material shrinks during polymerization, so we must be sure about complete setting of the material before we remove it from the patient mouth.

2. The impression may be casted (poured) 1 hr after removal.

3. The rubber impression materials are most accurate when they are used in thin section and this will necessities the use of special tray when taking the impression, to reduce the amount of the impression material so that we reduce the dimensional change that will occur.

4. The temperature and humidity may reduce the setting time.
5. Alteration in the ratio of catalyst to base will affect the setting time of the material.

**Gingival retraction**

In cases when the finishing line is located below the level of the gum (subgingivally) or with the level of the gum, we need to do gingival retraction, a procedure by which the finishing line is temporarily exposed by enlarging the gingival sulcus so that we can take a good impression which involves the details of the end margin of the preparation that is located subgingivally.

**Objectives of gingival retraction**

1. To create an access for the impression material to the area of the preparation that is located subgingivally.
2. To provide enough thickness of the impression material at the area of the finishing line to prevent tearing and distortion of the impression material.
3. To control the amount of fluid in the gingival sulcus (crevicular fluid) that will cause voids in the impression.

**Techniques of gingival retraction**

1. Mechanical.
2. Chemo-mechanical.
3. Gingival retraction paste (cordless technique).
4. Electrosurgical.
5. Laser.

1. **Mechanical:**

   In this technique, we apply pressure on the gingiva to open the gingival sulcus. It might be done by either of the followings:
   - Construction of a temporary crown with a slightly long margin leaving it in place for 24 hours, or
   - Using a plane retraction cord (free of any medicament) which is the most common.

   **The retraction cord** is a special cord made of cotton which comes either plane (free of medicament), or is pre-impregnated with a medicament (usually a vasoconstrictor). Using a plane retraction cord is considered as a mechanical means only.
2. Chemo-mechanical:

In this technique, we use a retraction cord that is pre-impregnated with a medicament, usually a vasoconstrictor (adrenaline, aluminum chloride, or ferric sulfate). By packing this cord with a plastic instrument (Ash No.6 or Ash No.49) in the gingival sulcus between the gingival tissue and the prepared tooth, the cord will mechanically push the gingiva away from the finishing line, and the combination of the chemical action of the medicament and the pressure exerted by the cord will cause a transient gingival ischemia. This will lead to shrinkage of the gingival tissue and control the fluid seepage from the gingival sulcus.

The retraction cord is left inside the gingival sulcus all around the tooth for 10 minutes. The working area should be kept dry during this period. Then the cord can be removed leaving the gingival tissue in an expanding state. This will provide a space to inject the impression material all around the tooth at the area of the finishing line by the use of an impression syringe.

3. Gingival retraction paste (Cordless technique):

In most cases, gingival retraction cord is the most effective method for retracting tissue to the depth of the sulcus. Unfortunately, gingival retraction cord may injure the gingival sulcular epithelium and the gingival bleeding is difficult to control when packing a cord into the sulcus making impression difficult or impossible. Using a retraction cord requires proper tissue manipulation and is technique sensitive. For this reason a new class of gingival retraction materials has been introduced in the form of retraction paste like Expasyl (Aluminum chloride 15%) and Magic Foam Cord (Polyvinylsiloxane, addition type silicone elastomer).

The advantage of cordless retraction technique is providing a non-traumatic, non-invasive tissue management and excellent hemostasis in the gingival sulcus for fixed prosthodontic impressions.
4. Electro-surgical:
In this technique, an electro-surgical unit could be used to remove the gingival tissue from the area of the finishing line with the advantage of controlling the post-surgical hemorrhage. However, electro surgery is contraindicated when there is gingival inflammation or periodontal disease. In this case, gingivectomy could be performed.

5. Laser (ND-YAG).

Impression Techniques:-

1. Single stage tech.
2. Two stage tech.
3. Putty wash tech.

Single stage tech.:-
Most of the time we use this tech when we have impression material with single viscosity (mostly medium viscosity material) e.g. Polyether, after we mix the impression material part of it is loaded in an impression syringe from the mixing slab, and the other part we place it on the special tray, we inject the material over preparation. And we start with the most critical parts (pin holes, F.L.) the whole preparation, and the remaining part of the dental arch. After wards, place the special tray over the dental arch, wait for complete set, and then removed.

Two stage tech.:-
Used with materials that have two viscosities light and heavy special tray, we start to inject the light body on the dental arch starting with the prepared tooth. After we finish injecting the impression material we place the special tray with the heavy body in the patient mouth. The pressure exerted by heavy body will create intimate contact between light body and the prepared tooth and will make direct flow of the light into the details of the preparation.

Putty wash tech.
This technique use a high viscosity material, we start to take impression with the heavy body (before or after preparation). If we make it before preparation: We leave the impression material until it sets inside the patient mouth. Then we remove it and do our preparation after that we start to mix the light body and load it, we reseat the tray inside the patient mouth and wait until setting occurs.
If we make the impression after preparation: we use it with spacer made of
polyethylene material, placed over the heavy body and inserted in the patient's mouth and wait until setting then remove the polyethylene (spacer). In putty wash technique, initial pressure will cause distortion of heavy body impression if pressure is not released the light body is allowed to polymerize completely, then on the with drawl of the impression, the heavy body layer relapse causing distortion of the light body.

In cases of bridge, initial pressure will cause displacement of the soft tissue covering the bridge area, this displacement will create space between the fitting surfaces of the pontic and the underlying mucosa. All techniques can be used in any type of preparation but it depends on the material.

**Impression for post crown**

In case of post crown, we need to take an impression for the inside of the root canal. Most of the time, it is difficult to insert the impression material inside the tiny root canal, and even when it is inserted inside the canal it might tear during removal or become distorted during pouring of the impression. Therefore, the impression material needs a type of reinforcement. Such reinforcement could be obtained either by the use of a plastic post (impression post) or by using a stainless steel wire. After injection of the light body inside the root canal, the impression post or the stainless steel wire is inserted inside the canal. This will support the impression material and prevents its tearing or distortion during removal of the impression.

**Digital impression**

Digital impression represents the most recent development in Dentistry. The basics of digital impression start with capturing an image of the prepared teeth. This system uses an intra-oral camera (scanner) to capture the desired image (optical impression). This image is then electronically transferred to a manufacturing facility which fabricates a working, articulated model. On this model, a multitude of different restorations can be designed (crowns, bridges, inlays/onlays, and veneers) with a special computer software, which is connected with a milling machine. This procedure is termed CAD-CAM (Computer Aided Designing - Computer Aided Manufacturing).

*To have good impression we do the following:*

1. Special tray and impression are ready.
2. Gingival retraction when necessary.
3-proper understanding of the physical property of the impression material which result in good handling of the material.

4-dry field must be used.

Because all elastic impression materials (except the hydrocolloid impression material) are hydrophobic that is they do not tolerate or displaced moisture, so any moisture will result in voids in the final impression. When we take impression for post crown we need impression for the root canal space, so the impression inserted inside the tiny canal and even when it fills the canal it might tear off or distorted during pouring the die materials (stone). So the impression material need a type of reinforcement either by a plastic post or by stainless steel wire placed after injecting of the impression material, the impression will not be torn or distorted because it is not movable. We should make the surface of the wire rough by burs in order not to be pulled away from the impression.

**After taking the impression we should inspect the impression for the following points:**

1. Finishing line of impression must be continuous from one surface to the other.
2. No air bubbles present on the surface of the impression especially at the area of F.L.
3. The attachment of the impression to the tray must be firm.